NOTES ON THE ANATOMY AND AFFINITIES OF THE CŒREBIDÆ AND OTHER AMERICAN BIRDS.

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Some five or six years ago I planned a paper on the Cœrebidæ which, for lack of time and material, has lain at a standstill until the present time. It is brought forward now, not because the necessary amount of material has been obtained, but because it seems probable that if delayed until the needed specimens are secured it will never be written, and also in the hope that these notes and figures may be of some service to other students and save the trouble of again going over the entire ground. It may, to some extent, be considered as a brief supplement to Dr. Gadow's paper on the Structure of certain Hawaiian birds, as comparisons are made with some of the species therein described.

One in search of the relatives of any passerine bird has before him, if not exactly a thankless task, something very nearly akin to it, and one in which even comparatively small results can be reached only by the expenditure of much time and labor. The birds which perch at the top of the avian tree are so many in number and so exasperatingly interrelated that any attempt at sorting them out is fraught with much difficulty, or, as Dr. Gadow puts it, "the examination of a small twig of the passerine branch of the Avine tree shakes and disturbs the whole branch, if not the whole top, of the famous ideal tree." So it has been in the present case. Representatives of the Mniotiltidæ, Meliphagidæ, Drepanididæ, Tanagridæ, and Fringillidæ, have been examined in the hope that the affinities of the Cœrebidæ might be made apparent; and I am compelled to confess that, on the whole, the result has been unsatisfactory, and that the examination of a considerable number of specimens has rather lessened my hopes that anatomical, and especially osteological, characters may be relied upon to show relationship among the passeres.

Of course one trouble lies in the fact that the so-called families of passeres, at least very many of them, are not families at all, or not the equivalents of the families of other groups of vertebrates. It is my belief that any group of vertebrates to be of family rank should be capable

of skeletal diagnosis, and this test applied to the passeres reduces them to a family or two, as has been done by Huxley and Fürbinger.

It would almost seem that, aside from purely negative results, the skeleton can be relied upon to show but two things, very general and very close affinities, for the variation of parts is so infinite that between any 10 given birds we may find every intermediate stage and establish relationships in all directions.

Then, too, characters which would be of much importance among mammals appear, from their instability, to be of but little value in birds. An example of this is found in the condition of the presacral vertebræ. In a large number of Passeres there are 4 presacrals, the third and fourth being fused and having a common transverse process; in others there are 5 presacrals, the fourth and fifth being fused. Such characters as these would seem to be of some importance, and yet *Himatione parva* has the third and fourth presacrals fused, while *H. sanguinea* has the fourth and fifth united. And these birds are undeniably closely related.

The same thing occurs again and again in other closely related species, such, for example, as *Merula migratoria* and *Turdus musicus*, while the instability of the character is well shown by the fact that it is by no means uncommon to find sacra in which, on one side, the third and fourth vertebræ are fused and on the other the fourth and fifth.

The degree of value to be assigned the pterylosis is yet unsettled, and this can only be done by accumulating and comparing the facts in the case. It would be a great service if some one with ample time and unlimited patience would plot the pterylosis, or even the configuration of the dorsal tract, in as many small birds as could be obtained, for it would then be possible to ascertain what correlation, if any, there is between tract pattern and other characters.

Between the continuous dorsal tract of a thrush and the inverted Y of a swallow there is a great difference, and this difference should have some definite meaning, exactly what meaning, is to my mind, not yet evident.

All the birds examined during the preparation of this paper have an uninterrupted dorsal tract whose shape appears to be specifically subject to great variation, but these variations are so slight and so innumerable that, except for general purposes, the pattern appears to be of little service.

The convolutions of the intestine are in very much the same case as the pterylosis for, judging by Dr. Gadow's figures and my own limited number of dissections, they are subject to great specific variation. There is certainly a decided difference between the alimentary canal (including the stomach) of birds so nearly alike as *Cœreba cyanea* and *C. cærulea*, and the genera of tanagers vary widely.

The indications are, as might not unnaturally have been expected, that such parts as the tongue and alimentary canal are subject to great

variation, so that the skeleton would seem to offer the most stable characters for classification, although, as has so often been said, it is by the *resultant* of characters that we must be guided.

The members of the Cœrebidæ herein discussed are *Cœreba cyanea*, *C. cœrulea*, *Certhiola caboti*, *C. bahamensis*,* and *Glossoptila campestris*. The palatal regions of the skulls of these genera are figured, and reference to them will be better than any detailed description.

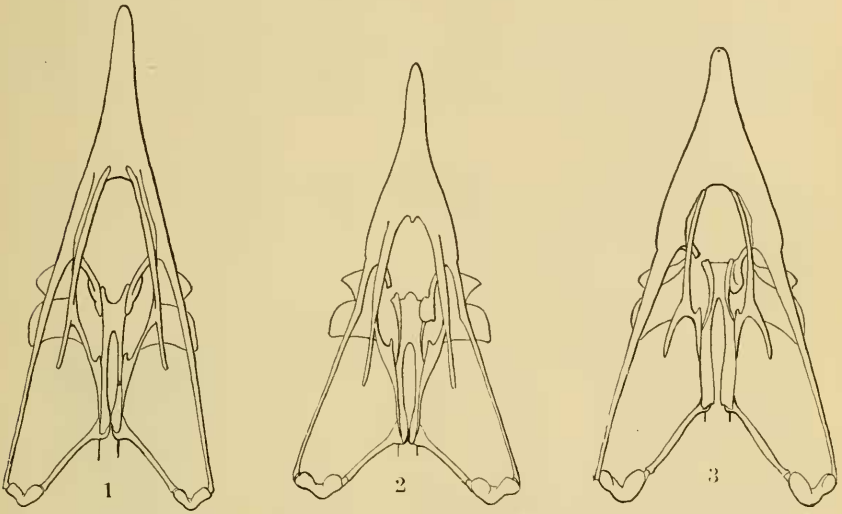

FIG. 1.—Views of palatal region of (1) *Cœreba cyanea;* (2) *Certhiola caboti;* (3) *Glossoptila campestris;* all enlarged.

The crania agree in the following particulars: the prepalatine bar is slender, the postpalatine portion produced backward and overhanging the anterior ends of the pterygoids. The anterior, interpalatine angle is small, almost abortive; the transpalatine process slender and spine-like. The more noticeable differences are as follows: In *Cœreba* the prepalatine is carried forward beneath the premaxillary; in *Certhiola* and *Glossoptila* it abuts upon and interlocks with the posterior, ventral part of the premaxillary. In *Cœreba* the palatine and pterygoid are completely fused; in *Certhiola* and *Glossoptila* they are separate. The pterygoids are anteriorly in contact, or very nearly so, in *Cœreba* and *Certhiola*; in *Glossoptila* they are separated by the sphenoid.

Certhiola and *Glossoptila* have septomaxillary splints united with the vomer. Dr. Parker figures them in *Chlorophanes atricilla*, and they are present in *Cœreba cœrula*, although I failed to find them in *C. cyanea*.

The tendinal perforations of the upper end of the tarsus, while arranged on the same general plan in those passerine birds examined, show a number of variations in the executions of details, some of which

* Also crania of *C. tricolor* and *C. portoricensis*. This last has the angle of jaw most produced of any species of *Certhiola* examined.

are shown in the figures. Their arrangement in the Cœrebidæ is very much that shown by *Myadestes*, except that in *Certhiola* 4 and 5 are merged in one.

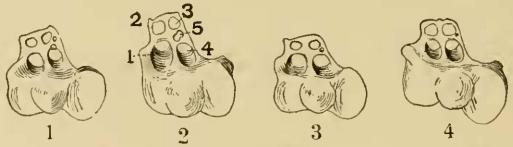

FIG. 2.—Hypotarsi of (1) *Phœornis obscura;* (2) *Merula migratoria;* (3) *Myadestes solitarius;* (4) *Hemignathus olivaceus;* all very much enlarged. The numbers in (2) refer as follows: [1] Foramen for tendon of *flexor longus hallucis;* [2] *flexor perforatus digiti* IV and slip to base of first phalanx of digit III; [3] *flexor perforatus digiti* III; [4] *flexor perforans digitorum profundus;* [5] *flexor perforans et perforatus digiti* II, and *flexor perforatus digiti* II.

The tongue is forked in *Cœreba* and *Certhiola*, brushy in *Certhiola*, laciniated or feathered in *Cœreba.* There is a decided difference between the tongues of *Cœreba cærulea* and *C. cyanea*, as is shown by the figures.

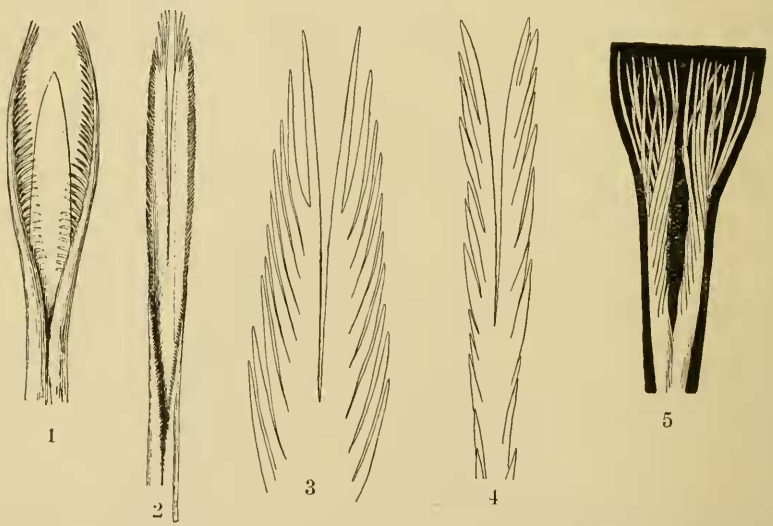

FIG. 3.—Greatly enlarged views of tip of tongue of (1) *Glossoptila campestris;* (2) *Acanthorhynchus tenuirostris;* (3) *Cœreba cyanea;* (4) *Cœreba cærulea;* (5) *Certhiola bahamensis;* number one is viewed from below, the others from above.

Cœreba cærulea comes near having a tubular tongue, but although the edges approach one another they do not meet except at the laciniated tip. In *Certhiola* the tongue is simply grooved down the center.* *Glossoptila* is noteworthy, from the fact that it has a trifid tongue, a thin, flat, pointed strip being produced between the laciniated branches.

* It makes a decided difference whether the tongue is examined in a moist or dry condition, for in drying the outer edges curl upwards and render the tongue more tubular, or gutter-like, than in its natural state. The specimens from which the figures in this paper were made were all kept wet while they were being drawn.

Certhiola has no crop, *Cœreba* has a well-marked crop-like dilatation of the œsophagus, and *Glossoptila* has a good-sized crop. The stomach is small in *Certhiola*, a little larger in *Glossoptila*, and largest in *Cœreba cærulea*. In all, the intestine is long and slender. There are many convolutions in *Certhiola*, comparatively few in *Cœreba*, while *Glossoptila* is somewhat intermediate between the two. In *C. cyanea* the intestine is ·090 mm. long, in *C. cærulea* ·125 mm.; both have two small cœca a short distance above the anal opening. The food of *Certhiola*, as indicated by the stomach contents, consists of small insects and spiders, that of *Cœreba* and *Glossoptila* consists of small berries, containing numerous small seeds.

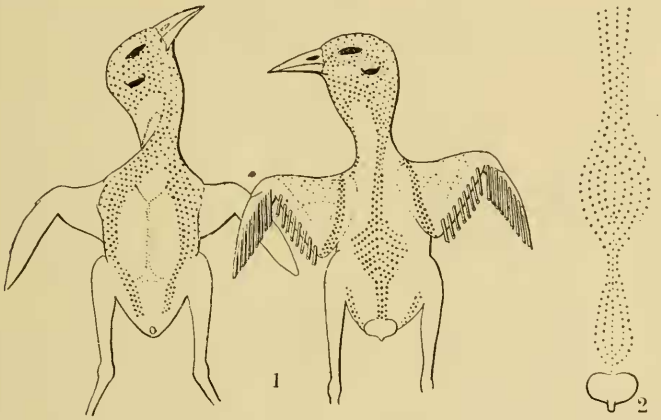

FIG. 4.—(1) Pterylosis of *Certhiola caboti*, a little more than half natural size; (2) Dorsal tract of *Glossoptila campestris*, natural size.

The feather tracts and apteria are, with trifling variations, as shown in the figure of *Certhiola caboti*. The pattern of the dorsal tract varies slightly according to the species, and the lengths of the median apteria, especially that on the under side of the neck, vary according to the length of the neck.

Glossoptila is different from the other Cœrebidæ in having a narrower dorsal tract, and much longer and looser feathers.

Professor Baird, in his "Review of North American Birds," considered the Cœrebidæ as nearly related to the Mniotiltidæ, being apparently largely influenced by the slender beaks of this last group, and by the peculiar tongue of *Dendroica tigrina*.

Dr. Gadow, in the "Birds of the Sandwich Islands," considers the Cœrebidæ as the nearest allies of the Sandwich Island Drepanididæ, this family being formed to accommodate the slender-billed brush-tongued birds peculiar to those islands.

Dr. Sclater* places the Cœrebidæ just before the tanagers, remarking that it is difficult to separate them from the tanagers on the one hand and the Muiotiltidæ on the other, and this position is that generally accepted.

* British Museum Catalogue of Birds.

In considering the relationships of the group, the pterylosis may be left out of the question, as it will not help us any. The figure showing the pterylosis of *Certhiola* might, with trifling alterations, do duty for *Cœreba*, *Dendroica*, *Geothlypis*, *Acanthorhynchus*, and some of the Fringillidæ, and since the same pattern is found in so many genera, including those but distantly related, it may be considered as very generalized.

The palate of the Mniotiltidæ differs from that of the Cœrebidæ in having the interpalatine process well developed, the transpalatine short and bluntly angular, and the palatines not produced backward over the pterygoids.

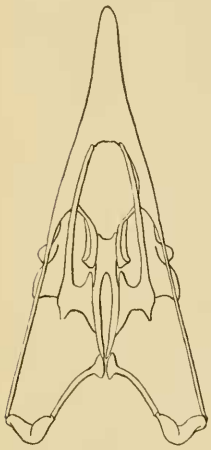

FIG. 5.—Palatal region of *Mniotilta varia*, enlarged.

In the general pattern of the palate, the shape and development of the interpalatine and transpalatine spurs, and in the amount of exposure of the sphenoid between the palatines, some of the tanagers agree very well with the Cœrebidæ. Others of the tanagers differ considerably in their palate from the Cœrebidæ, and there seems to be in the Tanagridæ more of an approach towards the union of the palatines beneath the sphenoid.

The Drepanididæ, as represented by *Vestiaria*, *Oreomyza*, *Hemignathus*, and *Himatione*, agree with the Cœrebidæ in the character of the transpalatine and interpalatine processes, and exceed them in the depth and production of the postpalatine. This feature is carried to its extreme in the Drepanididæ, and the same is true of the compression of the palatines, the free ventral edges of these bones approaching one another very closely, being in *Himatione sanguinea* almost in contact. The Drepanididæ have the sphenoid covered by the palatine, a feature which is not found in the Cœrebidæ, but occurs in some, although by no means all, or even in a large majority, of the Fringillidæ.* Among the skulls examined, those of *Certhiola* and *Himatione* bear the closest general resemblance to one another. *Cœreba* and *Glossoptila* have a small palato-maxillary, and so do some of the Mniotiltidæ. On the other hand, *Certhiola* and some species of *Dendroica* do not have this little bone.† It is wanting in *Dendroica discolor*, *coronata*, *pennsylvanica*, *Melospiza fasciata*, *melodia*, *Loxia curvirostra*, *Zonotrichia albicollis*, *Pipilo erythrophthalamus*, *Leucosticte griseonucha*, *Ammodromus* and *Parula americana*. Its exact value remains to be shown, for it appears in forms which are not related, at least closely, and drops out in some that

* That is, in the species which have come under my observation.

† The following species have a palato-maxillary: *Dendroica maculosa, vigorsi, æstiva, Cardinalis virginianus, Habia ludoviciana, Plectrophenax nivalis, Calcarius lapponicus.*

are nearly allied. It is present in the Swallows, but not in the Flycatchers or Thrushes; is well developed in such stout-billed Finches as *Cardinalis* and *Habia*, missing in *Coccothraustes*. It appears as a slender splint in *Plectrophanes* and *Calcarias*, and reaches a considerable size in *Rhamphocœlus* and *Pyranga*, while it is lacking in *Phœnicophilus*. None of the Drepanididæ and Meliphagidæ examined have a palatomaxillary.

None of the Mniotiltidæ or Tanagridæ have the angle of the jaw produced, nor do the genera *Cœreba* and *Glossoptila*. In *Certhiola*, however, the angle of the jaw is slightly produced, and this occurs in *Oreomyza*, *Vestiaria*, *Himatione*, and to a less extent in *Hemignathus*. The production of the angle is marked in *Acrulocercus*, and reaches a maximum in *Anthochœra carunculata*. *Acanthorhynchus* and *Tropido-*

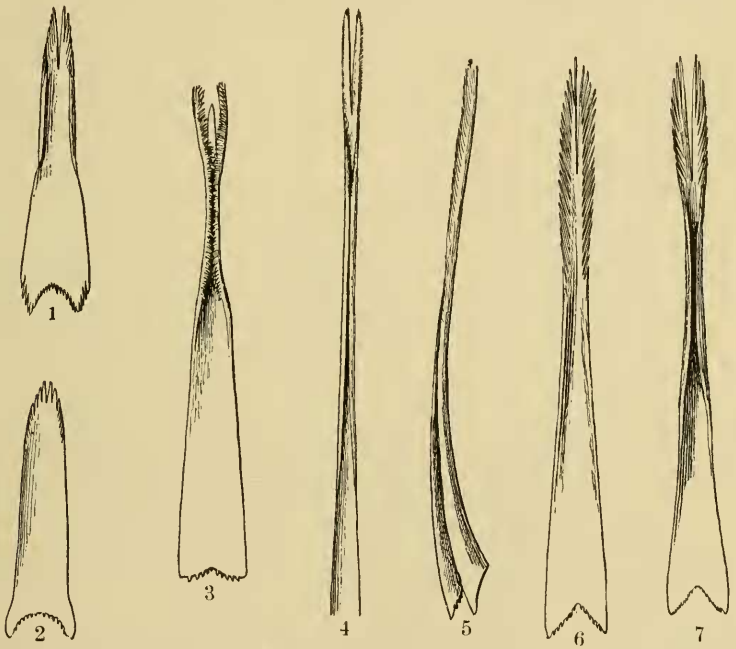

FIG. 6.—Tongues of *Dendroica tigrina*; (2) *Dendroica coronata*; (3) *Glossoptila campestris*; (4) *Acanthorhynchus tenuirostris*; (5, 6) *Cœreba cyanea*; (7) *Cœreba cœrulea*; all enlarged.

rhynchus do not have the angle of the jaw produced, although they are "tenuirostral" birds, and the character is one that seems to have no correlation with length of bill. Like many other points in the anatomy of the Passeres, more observations are needed regarding the occurrence of this character, although it would seem that it should be of some importance. It does not occur in many birds, but is found in some of the Icteridæ.

The tongue in the Mniotiltidæ is of moderate length, with very slightly upturned margins, cleft a little at the tip, and slightly brushy. *Dendroica maculosa* and *D. tigrina* represent the extremes so far as speci-

mens have been examined. The tongue shown in fig. 5, page 163, "Review of North American Birds," is unfortunately not the tongue of *Dendroica tigrina*. There has evidently been a transposition of specimens, and fig. 4, which is said to be that of *Dacnis*, is probably that of *D. tigrina*. As the shape of the tongue was the principal character of the genus *Perisoglossa*, the genus would for this reason, if for no other, be untenable; but even had the tongue been as figured, it would hardly seem a character of sufficient importance for the establishment of a genus.

The tongue of the Tanagridæ may be slightly bifid as in *Pyranga*, *Tanagra*, and *Rhamphocœlus*, or thick, fleshy, and fringed, as in *Saltator atriceps*, but so far I have found no species in which the tongue bore any resemblance to that of *Cœreba*.

Among the Drepanididæ, *Himatione*, *Hemignathus*, and *Vestiaria* have very perfect tubular tongues, the upturned edges meeting or even lapping over one another slightly, being so firmly apposed that it is often a difficult matter to force them apart. A few filaments at the end, and here and there along the edge, constitutes the entire feathering of the tongue.

Oreomyza has the commencement of a tubular tongue, but, owing to its shortness, the tubular structure is not carried out. None of these tongues are deeply cleft or widely feathered at the tip, as in the Cœrebidæ, and none approach the peculiar condition found in *Certhiola*, which has a two-branched tongue, with a twisted brush on either branch, and a shallow groove down the center of middle third of the tongue.

The general pattern of this tongue is very much like that of the Australian *Meliornis* while the nearest approach to such a tongue as that of *Cœreba cœrulea* is found in the Australian *Acanthorhynchus tenuirostris*, and in this bird the cœrebine pattern is carried to the extreme, the tongue being extremely long, slender, bifid, feathered at the tip, and tubular for a part of its length.

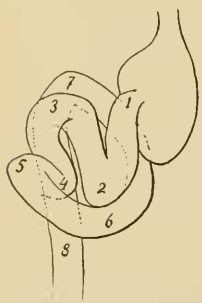

Fig. 7.—Intestinal convolutions of *Tanagra cana*.

The alimentary canal of the Mniotiltidæ is, as a rule, comparatively simple, but in *Dendroica coronata* the convolutions of the intestine are almost exactly the same as in *Cœreba*. The stomachs of all Mniotiltidæ examined contained insects. There is no crop in this group and the stomach is large and somewhat pyriform in shape.

The tanagers are fruit-eaters, are devoid of a crop, and have the largest intestine and simplest convolutions of any birds examined.

In the complexity of the alimentary canal there is a parallel

between *Certhiola* and the Drepanididæ, and the convolutions of *Hemignathus olivaceus* very nearly coincide with those of *C. caboti.**

But in both groups there is varying complexity of convolution among the different species, and in neither is there any adherence to a given pattern. Among the Sandwich Islands birds there is, in the majority

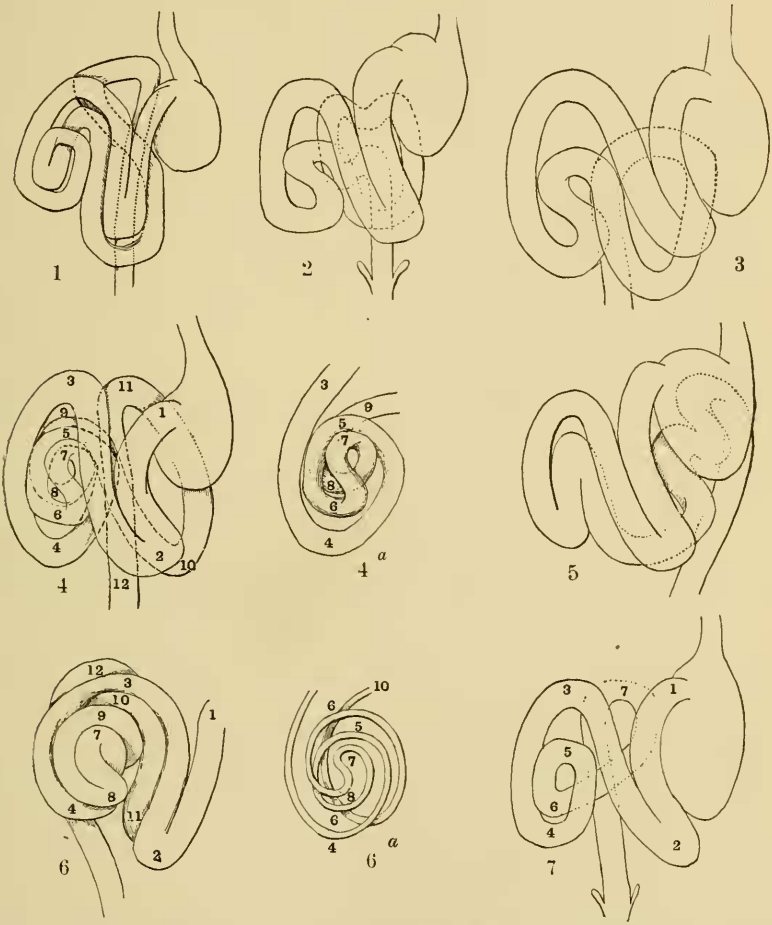

Fig. 8.—Intestinal convolutions of (1) *Glossoptila campestris;* (2) *Cœreba cyanea;* (3) *Dendroica coronata;* (4) *Certhiola caboti;* (4a) *Certhiola caboti*, central portion; (5) *Cœreba cœrula;* (6) *Hemignathus olivaceus;* (6a) *Hemignathus olivaceus*, with coil opened out to show convolutions; (7) *Acanthorhynchus tenuirostris*.

of specimens figured, a slight peculiarity in the manner in which the intestine begins to uncoil from the center. When looking from below at the right side of the viscera, the intestine is seen, roughly speaking, to start from the stomach and in a decreasing spiral or series of loops

* There is at first sight an apparent discrepancy between Dr. Gadow's figure and that shown in fig. 8 (6), of this paper, but this is due to the fact that Dr. Gadow's specimen has a longer and more closely twisted intestine, so that the point of reversion is different in the two.

coil into a knot or short loop, whence it uncoils or unfolds in an increasing spiral. In *Loxioides*, *Psittacirostra*, *Himatione*, *Vestiaria*, and *Hemignathus* the first turn of the intestine from the center is to the left, while in the American species figured it is to the right. The point is one of little or no value, but among the species figured the difference exists.

My only specimen of *Acanthorhynchus* was doubly unfortunate; first in being neatly shot through the palate, completely destroying that region; and, secondly, in having the intestine in so tender a state that it was difficult to trace its convolutions. Hence I do not feel quite positive that the figure is entirely correct, although it is very nearly so, and if there is any error it lies in the portion beyond the central knot and consists in the omission of some convolutions. It is much simpler than in *Certhiola*, but not unlike *Cœreba*, while a little more complexity beyond the central knot would make the general pattern of the intestine very much like that of *Glossoptila*.

To sum up: In the character of their palate the Cœrebidæ differ from the Mniotiltidæ and resemble in some points the Drepanididæ and some of the Tanagridæ.

The Drepanididæ differ from all the above-mentioned groups except *Certhiola* in the production of the angle of the jaw.

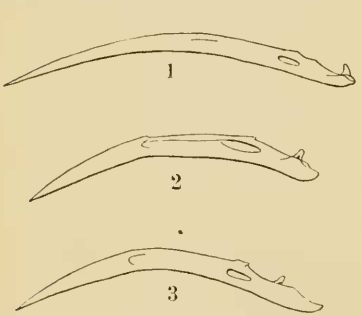

Fig. 9.—Lower mandible of (1) *Cœreba cœrulea*; (2) *Certhiola portoricensis*; (3) *Oreomyza bairdii*; all twice natural size.

In their tongue the Cœrebidæ are markedly different from the Mniotiltidæ, but it is largely a difference of degree rather than of kind. They differ *in toto* from the Tanagridæ, are quite distinct from the Drepanididæ, and find their nearest homologue in *Acanthorhynchus*.

As regards the Drepanididæ, it may be thought that this distinction is very much a matter of opinion, but to me the two patterns of tongue seem quite different, though both derivable from such a tongue as that of *Dendroica*.

It would, perhaps, require less modification to derive the tongue of the Drepanididæ from such an one as that of *Icterus icterus*, as this is considerably upcurved along the edges, is not greatly feathered, and is, considering its size, less fleshy at the basal portion than that of *Dendroica*.

It must be borne in mind, too, that there are three distinct types of tongue among the Cœrebidæ and that no comparison can be made with them in this particular as a group.

In complexity of alimentary canal they much exceed the Mniotiltidæ (except *Cœreba cyanea*, noted previously), bear no resemblance at all to the Tanagridæ, and are approached by the Drepanididæ.

As groups of birds are constituted the Cœrebidæ are certainly sufficiently distinct to stand apart, and the gap between them and the Mniotiltidæ seems widest, although this may be due to a tendency on my part to place considerable weight on the general pattern of the palate.

The relationship with the tanagers is not very close, although such short-billed forms as *Chlorophanes* and *Dacnis*, which unfortunately were not available, might bring the two groups a little closer.

In size, form, pterylosis, structure of tongue, and pattern of convolutions of alimentary canal, there is a strong resemblance between *Cœreba* and *Acanthorhynchus*, and so far the two forms exhibit a most interesting case of parallelism. The palate, too, on superficial examination, looks not unlike that of *Glossoptila*, but as Dr. Parker points out in the second part of his memoir on the Skull of Ægithognathous Birds, there is a striking dissimilarity in the fact that in *Acanthorhynchus* the palatines run outside the palatal process of the premaxillary instead of along the inner side, as in passerine birds generally.

Finally, it must be said that the members of the Cœrebidæ do not form a homogeneous group, for the family contains at least three well-marked types, *Cœreba*, *Certhiola*, and *Glossoptila*, and these types differ from one another in a very marked degree. While *Dacnis* and *Chlorophanes* have not been examined by me, the figures of skulls and tongues of these genera indicate that they belong near *Cœreba*. These genera form a well-marked group containing those species nearest to the Mniotiltidæ and characterized by a long, cleft, feathered, but not suctorial tongue, small crop-like dilatation of the œsophagus and simply convoluted intestine.

Certhiola has a bifid, brushy tongue, no crop, extremely complicated intestine, and produced angle to the mandible. The tongue resembles that of some of the Meliphagidæ; the other characters are like some found in the Drepanididæ. *Glossoptila*, with its loose ptilosis, decided crop and unique, trifid tongue, is equally well characterized and certainly should stand apart, seeming to hold with respect to Cœreba much the same position that *Chamea* does with the wrens.

The Anatomy and Affinities of Certhidia.

At the suggestion of Mr. Ridgway I have examined three specimens of *Certhidia salvini*, kindly provided by Dr. G. Baur, with a view of ascertaining whether or not the suggestion of Cœrebine affinities presented by its external appearance was borne out by its anatomy.

The pterylosis is of the orthodox passerine pattern and the dorsal tract has a diamond-shaped outline, similar to that found in *Dendroica* and many other small birds. The testimony of the skull is unmistakable, for it has the short, subangular, transpalatine processes, and well

developed interpalatines characteristic of the Mniotiltidæ, and well shown by the common warbler of this Galapagos group, *Dendroica aureola*.

The Cœrebine skull, on the other hand, is characterized by the fining down of the palatal region, the transpalatines being reduced to mere spikes, while the interpalatine spur is abortive or small. The cranium of *Certhidia* is a trifle shorter than that of the majority of the Mniotiltidæ examined and has a little more material in the palatines. The hypotarsus is also like that of *Dendroica* in its configuration, slight but perceptible differences existing between it and the corresponding region of any of the Cœrebidæ. There is apparently nothing specially characteristic in the shoulder muscles, their arrangement being practically similar in *Certhidia*, *Dendroica*, *Cœreba*, and many other small birds.

The tongue is warbler-like in shape and character, being moderate in length and slightly cleft and bifid. It is a trifle thicker and more fleshy than in such a bird as *Dendroica aureola* and not at all gutter-shaped. All this is in direct contrast to the elongate, feathered, hollowed-out tongue of *Cœreba*, and not at all like the cleft, brushy tongue of *Certhiola*, although all three forms agree in one respect: long or short, plain or feathered, the tongue is not suctorial, for even in long-billed *Cœreba* the hyoid stops low down on the base of the skull and lacks the elaborate arrangement of muscles found in truly suctorial birds. The intestinal convolutions are quite simple, much as in *Cœreba* and *Dendroica coronata* and *aureola*, but not exactly like either, although, curiously enough, precisely similar to the convolutions of *Cinnyris bifasciata*. There is, however, no crop-like dilatation of the œsophagus as in *Cœreba*. The cœca are moderate, and in the best specimen examined the *bursa fabricii* was very large.

All in all, the anatomy of *Certhidia* points to a very near relationship with *Dendroica*, and indicates that the genus surely belongs among the Mniotiltidæ.

Remarks on the Affinities of Myadestes and Phœornis.

The skull of *Myadestes* is rather short, and on its superior aspect bears a considerable resemblance to that of *Ampelis*. The maxillary process of the nasal is short, not expanded distally, and abuts upon, but does not fuse with the maxillary. In the thrushes this process is wider and continued for a little distance along the maxillary, but does not unite with it. *Phœornis* resembles the thrushes in these particulars. In *Tyrannus* the descending process of the nasal is narrowest near its origin, expands distally, and ankyloses with the maxillary.

The prepalatine bar of *Myadestes* is narrow, as in *Ampelis*, the transpalatine angle much like that of *Phœornis*. The interpalatine angle is blunter in *Myadestes* than in *Ampelis*, in this respect resembling that of *Phœornis* and the thrushes.

Tyrannus differs from the genera mentioned above in the early and complete fusion of the prepalatines with the premaxillaries. *Ampelis* is peculiar in the large symmetrical ossifications of the anterior trabeculæ which articulate with the vomer.

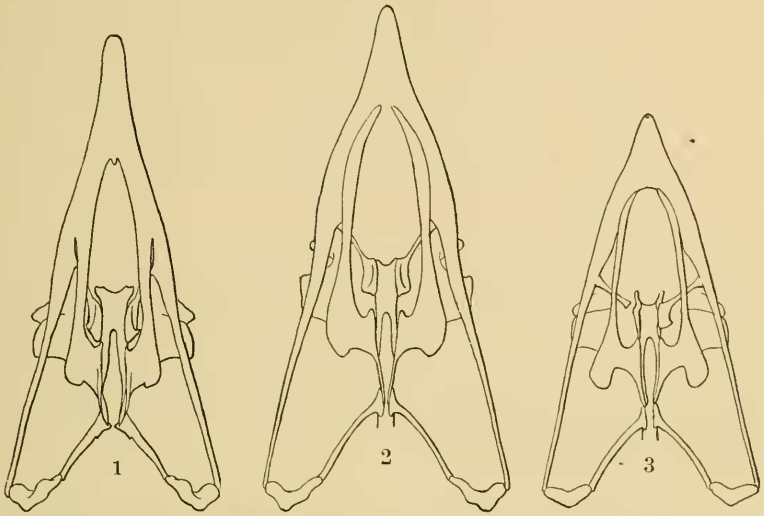

Fig. 10.—Palatal region of (1) *Merula migratoria;* (2) *Phaeornis obscura;* (3) *Myadestes solitarius;* all enlarged.

Myadestes, like *Tyrannus*, has a flat non-pneumatic maxillo palatine, although that of *Myadestes* is the less hooklike and more expanded of the two. *Phœornis* has a maxillo palatine like that of a thrush.

The manubrium of *Myadestes* is rather wide and low, similar to that of *Phœornis*, these birds in this particular departing from the thrushes as well as from *Ampelis*.

The œsophagus is large and there is no crop. The stomach is large, with strong walls. The intestine is very short, measuring but 0.145 m. in length. The stomach was full of small berries mingled with a few remains of insects.

The dorsal tract is almost straight in *Myadestes*, slightly different from what occurs in *Turdus pallasii*.

Myadestes was placed by Gray with the Ampelidæ, but is included among the thrushes by Dr. Stejneger.

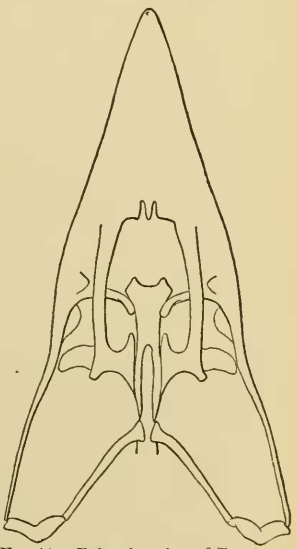

Fig. 11.—Palatal region of *Tyrannus carolinensis*, enlarged.

While the bird has some leanings toward the Ampelidæ it seems to have more decided affinities with the thrushes,

although it is by no means a typical thrush. It certainly has no near relationship with the Tyrannidæ.

FIG. 12. — Dorsal tracts of (1) *Myadestes solitarius*; (2) *Turdus pallasii*; reduced.

Neither *Myadestes* nor *Phæornis* have any trace of a metapterygoid, but while this little process is quite generally present in thrushes, it varies greatly in the amount of development. It is best developed in *Merula aurantia* and *M. migratoria*, is small in *Turdus mustelinus* and *pallasi*, rudimentary or even wanting in *swainsoni* and *fuscescens*. When the metapterygoid is small it is occasionally difficult to decide whether a minute process is present, or merely a prolongation of the sphenoid foot.

The turdine resemblances of *Phæornis* have already been pointed out by Dr. Gadow, although he seems to have had doubts about positively placing the birds together. Working over the question anew my own observations corroborate those of Dr. Gadow, but I would go a step farther and until it was shown to be otherwise definitely place *Phæornis* with the Turdidæ. Certainly if *Myadestes* is to be considered a thrush *Phaeornis* is doubly one.

Remarks on the Affinities of Phainopepla Nitens.

Phainopepla was placed by Gray near *Ampelis*, and here is where it undoubtedly belongs. The skulls of the two are very much like, particularly in the palatal region, and both possess a large, free, swollen lachrymal, this last being a point of much importance, since such a lachrymal is of rare occurrence among birds. The quadrates of *Ampelis* and *Phainopepla* agree with each other in minute as well as general characters, as do also the pneumatic maxillo palatines.

FIG. 13.—Dorsal tract of *Phainopepla nitens*, reduced.

The characters which separate *Myadestes* from *Ampelis* separate it also from *Phainopepla*.

The very marked resemblances between the skulls of *Phainopepla* and *Ampelis* render it, in this instance, unnecessary to go into further details, but it may also be said that the general contour of the dorsal tracts in the two species agree very well also, although the outer angles of the tract are a little more rounded in *Phainopepla* than in *Ampelis*.